Idaho State Department of Agriculture
Division of Agricultural Resources

Payette Ditch
Water Quality Monitoring Report
April 2003 through October 2003

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ISDA Technical Report Summary W-12

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Introduction

The Idaho State Department of Agriculture (ISDA) recently completed a water quality monitoring project on the Payette Ditch. The Payette Ditch is an irrigation conveyance that originates at the Payette River diversion and flows northerly approximately 20 miles prior to discharging into the Weiser River. The monitoring was conducted by ISDA at the request of the Weiser River Watershed Advisory Group (WAG) and the Natural Resource Conservation Service (NRCS) office in Payette. The Weiser River is currently under Total Maximum Daily Load (TMDL) development and the Weiser Wag was interested in understanding the inputs from the Payette Ditch into the Weiser River. The NRCS had a request from a land owner and the Payette Ditch company to evaluate the water quality conditions of the ditch. The Payette Ditch has diversions and spill ways that divert water for irrigation purposes. Some of this irrigation water eventually makes its way back into the Snake River. This return water could possibly effect the water quality conditions of the Snake River.

There were three monitoring stations established along the Payette Ditch to evaluate water quality. Station PD-3 was located at the Payette Ditch control structure where Little Willow Creek confluences with the Payette Ditch. Station PD-2 was located just north of NE 25th Avenue and just east of Hill Road. PD-1 was located southeast of the city of Weiser just south of where the river crosses under Cove road and the Payette Ditch discharges into the Weiser River (Figure 1).

ISDA monitored twice a month from April 30 through October 21, 2003. Samples were analyzed for total suspended solids (TSS), total volatile solids (TVS), total phosphorus (TP), dissolved phosphorus (DP), and Es-

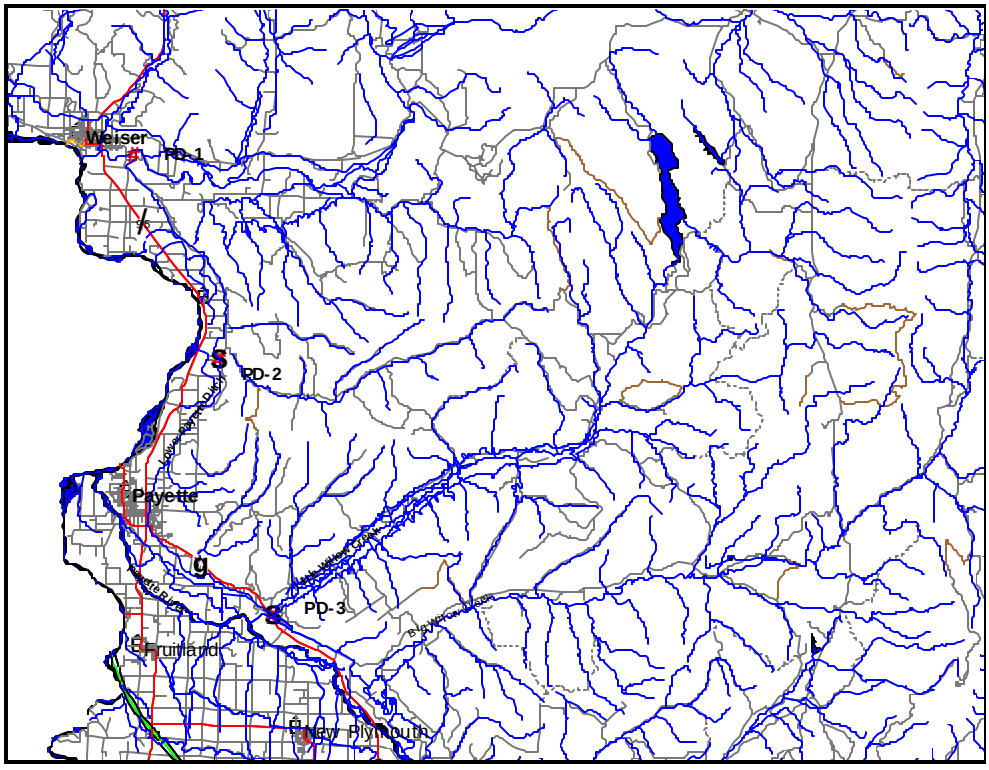

Figure 1. Payette Ditch site map.

cherichia Coli (*E-coli*). On-site measurements were taken for dissolved oxygen, temperature, percent saturation, conductivity, total dissolved solids, and pH (Appendix A). Discharge measurements were only collected at sites PD-1 and PD-2. The PD-3 site is at the concrete control structure on the Payette Ditch and had no recording device or any way to measure accurate discharge.

General Results

Total Suspended Solids (TSS)

The total suspended solids (TSS) concentration within Payette Ditch followed a somewhat typical pattern that is observed in irrigation water conveyances. The higher concentrations occurred earlier in the irrigation season and then slowly dropped off as the system became more stable and the irrigation season started to wind down (Figure 2). The mean concentration of TSS for April through July 2003 was 71 mg/L at PD-1, 83 mg/L at PD-2 and 27 mg/L at PD-3. The remaining part of the sampling period (August through October 2003) showed reduced TSS mean concentrations for PD-1 (23 mg/L), PD-2 (26 mg/L) and PD-3 (18 mg/L). The overall mean concentrations for PD-1, PD-2 and PD-3 for the entire monitoring period are presented in Table 1.

Statistics	PD-1	PD-2	PD-3
Mean (mg/L)	48.7	56.9	22.8
Minimum (mg/L)	5	12	8
Maximum (mg/L)	149	131	49
St. Deviation (mg/L)	40.8	36.3	11.2

Table 1. Payette Ditch TSS statistics (mg/L).

PD-3 is the furthest upstream station and did not exhibit any large spikes in TSS concentrations. PD-1 showed a high TSS concentration on April 30 (149 mg/L) and PD-2 had a high of 131 mg/L on May 29, 2003 (Figure 2).

TSS loads could only be calculated at stations PD-1 and PD-2. Discharge at station PD-3 could not be measured and there was no recording device at the site. The average TSS load at PD-2 was 18,805 lbs/day. The load based on PD-1 measurements, prior to discharging into the Weiser River, was reduced to 4,024 lbs/day. The TSS load over the 8.2 miles between the two stations decreased by 14,781 lbs/day. The reason for the large load discrepancy between stations is due to the rate of discharge. Average discharge rate at PD-2 was approximately four times greater then discharge measured at PD-1.

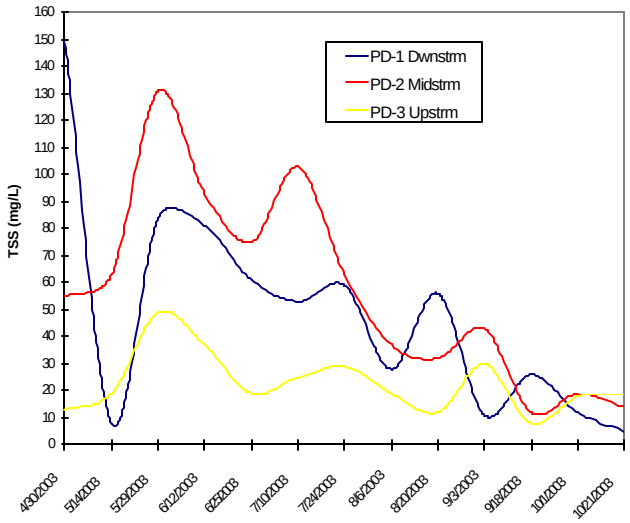

Figure 2. Payette Ditch TSS concentrations.

Phosphorus

Payette Ditch discharges directly into the lower portion of the Weiser River. According to the Snake River Hells Canyon Complex (SR-HC) TMDL the Weiser River would need to reduce its TP load to the Snake River by approximately 62%. The TP target within the Snake River is 0.07 mg/L and may be applied to the Weiser River. This is a total phosphorus target which includes both particulate and dissolved phosphorus.

The majority of the phosphorus within the Payette Ditch is of the particulate form. The overall percentage of dissolved phosphorus is low (Appendix A). The average phosphorus concentration increases from upstream PD-3 (0.06 mg/L) to midstream PD-2 (0.10 mg/L) to downstream PD-1 (0.13 mg/L) (Table 2). The highest TP concentration was 0.21 mg/L recorded at both station PD-1 and PD-2 on May 29, 2003 (Figure 3).

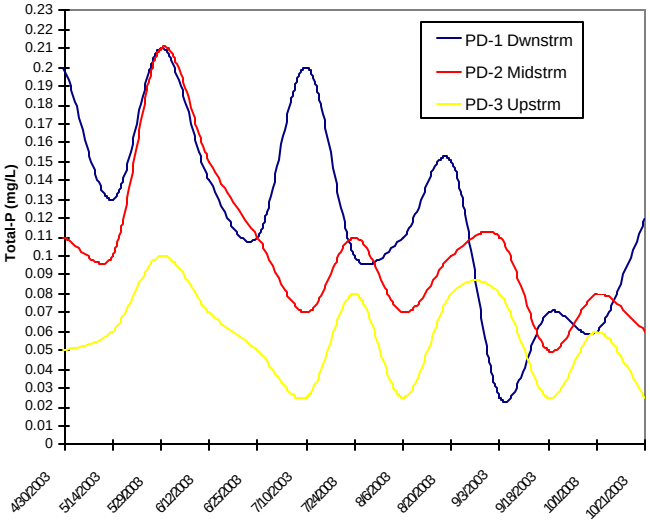

Figure 3. Total Phosphorus concentrations (mg/L).

If the phosphorus concentration is required to be lowered for the Weiser River, to meet the SR-HC TMDL goal of 0.07 mg/L, the Payette Ditch will require reductions to meet this goal (Table 2).

Site	Mean TP (mg/L)	TMDL TP Goal (mg/L)	% Reduction TP
PD-1	0.13	0.07	46%
PD-2	0.10	0.07	30%
PD-3	0.06	0.07	0%

Table 2. Percent TP reductions to meet SR-HC TMDL goal.

Discharge

On average, discharge rates from station PD-2 to PD-1 declined significantly. The mean discharge at PD-2 was 61.3 cubic feet per second (cfs) as compared to 15.3 cfs at PD-1. There was an average decrease of 45.9 cfs between station PD-2 and PD-1. The loss of water comes from diversions for irrigation, spills into other canals and ditches, some leakage, and a small loss to evaporation (Figure 4).

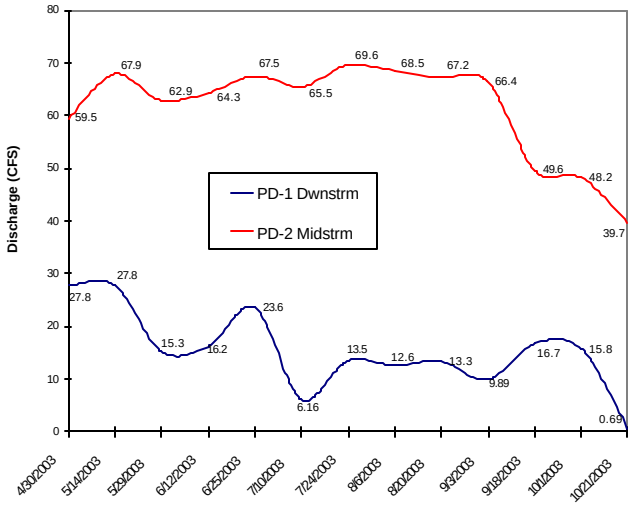

Figure 4. Discharge rate Payette Ditch.

Temperature

The Weiser River is listed for support of cold water aquatic life. This designation requires a water temperature of 22°C or less: with a minimum daily average of 19°C. The Payette Ditch exceeds the cold water biota temperature of 22°C during the month of July at all of the monitoring stations (Figure 5). The highest temperature recorded at stations PD-1, PD-2, and PD-3 occurred on July 24, 2003 and were 26.2°C, 24.7°C, and 24.5°C, respectively (Figure 5).

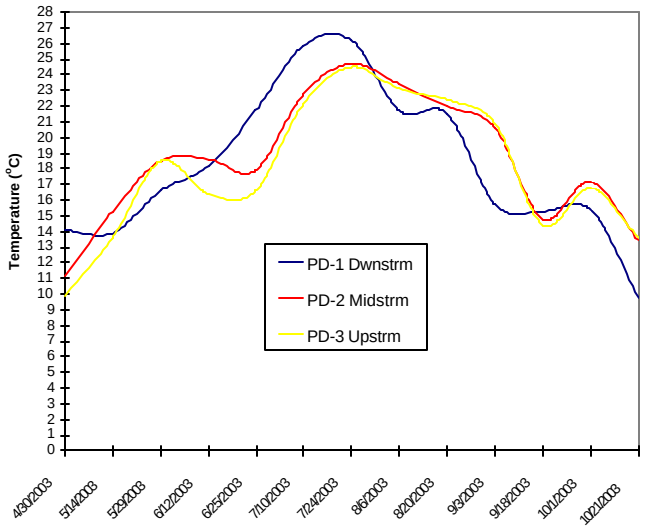

Figure 5. Payette Ditch instantaneous temperature

In August, the two upstream stations still exceeded the 22°C, but the water cooled to below that level (21.7°C) at PD-1 prior to discharging into the Weiser River. Temperature statistics are presented in Table 3.

Statistics	PD-1	PD-2	PD-3
Mean (°C)	18.2	18.5	17.9
Minimum (°C)	9.8	11.1	9.9
Maximum (°C)	26.2	24.7	24.5
St. Deviation (°C)	4.9	4.1	4.4

Table 3. Payette Ditch temperature statistics

The Payette Ditch is a thermal source to the Weiser River and may require efforts to lower its overall thermal inputs during the critical heating period for the Weiser River.

Bacteria (*E-coli*)

The Payette Ditch was tested for *E-coli* bacteria to determine if it may be a source of bacteria to the Weiser River. The Weiser River is designated for primary contact. Primary contact waters of the state are not to contain *E-coli* bacteria in a single sample of 406 colony forming units (CFU) or a geometric mean of 126 CFU from a minimum of five samples collected over a 30 day period.

Monitoring site PD-1 which discharges directly into the Weiser River had a single sample exceedance of the 406 CFU concentration on three occasions; June 12, July 10, and 24, 2003 (Table 4).

Date	PD-1	PD-2	PD-3
4-30-03	210	220	150
5-14-03	140	360	450
5-29-03	10	690	550
6-12-03	450	160	530
6-25-03	230	<10	360
7-10-03	>2500	14	>2500
7-24-03	1200	350	170
8-6-03	340	460	100
8-20-03	300	220	140
9-3-03	20	160	80
9-18-03	90	70	80
10-1-03	20	120	210
10-21-03	50	80	130

Table 4. Payette Ditch *E-coli* (CFU) results single sample.

Conclusions

Three monitoring sites were established along the approximate 20 miles of the Payette Ditch. The most important site PD-1 gives some indication of the pollutant loading that enters the Weiser River. The data seems to indicate that the Payette Ditch supplies pollutant loads of TSS, TP and temperature into the Weiser River.

The TSS average daily load of 4,024 lbs/day into the Weiser River should be addressed. Although the load at PD-1 (4,024 lbs/day) is much lower then the recorded load at PD-2 (18,805 lbs/day); the large difference of 14,781 lbs/day between sites needs to be evaluated. This unaccounted load of 14,781 lbs/day might be retained on fields during irrigation or it could be transferred to the Snake river through various conduits.

TP concentrations at the mouth of Payette Ditch (PD-1) indicate that reductions of up to 40 percent may be required along the ditch to meet the proposed 0.07 mg/L TP target concentration for the Weiser River. The same scenario exists for TP loading as for TSS loading. Somewhere between site PD-2 and PD-1 approximately 22 lbs/day of TP or a portion thereof are either being utilized during irrigation, stored or transported to the Snake River.

Thermal inputs from the Payette Ditch exceeded the 22^{o}C maximum for cold water biota only during the month of July. Irrigation water demands are high in July as indicated by the difference in discharge measured between stations PD-1 and PD-2. During July there was a difference of 57.8 cfs between station PD-2 and PD-1. The small average discharge in July at PD-1 (9.8 cfs) may not be of sufficient volume to increase the overall temperature of the Weiser River. The Weiser River is also being supplemented during July by water from Crane Creek reservoir. The small thermal input from the Payette Ditch probably will not impact the temperature of the Weiser River nearly as much as the ambient air temperature during the summer months.

As indicated in Table 4, the Payette Ditch had only three occasions where its discharge exceeded the primary contact level for *E-coli.* Further evaluation of the water quality at station PD-1 would be necessary to further determine if the Payette Ditch is effecting the primary contact status of the Weiser River.

Recommendations

Further evaluation of the Payette Ditch may be warranted to better understand the movement of TSS and TP within the system. Since the majority of phosphorus is in the particulate form; BMPs that are installed to reduce TSS will also be effective in the removal of TP. A mass balance evaluation of the ditch may help determine where and when major loads of TSS and TP are entering or leaving the ditch. This evaluation would also help determine how much of a pollutant load from the Payette Ditch is actually entering the Snake River.

References

Idaho State Department of Environmental Quality, 2003. Snake River-Hells Canyon TMD.

Appendix A

Payette Drain	Location @	bridge just	east of town	where drain	enters the	Weiser R.						
PD-1												
Date	DO	Temp	%Sat	Cond.	TDS	pH	Discharge	TSS	TVS	TP	OP	e-coli
4/24/2003	8.84	14.1	85.6	109	54	7.88	27.8	149	13	0.2	<0.05	210
5/8/2003	9.58	13.9	93.1	121	60	8.07	27.8	8	5	0.13	<0.05	140
5/22/2003	9.14	16.6	94	118	59	7.9	15.3	84	9	0.21	<0.05	10
6/4/2003	8.98	18.2	95.3	99	50	7.99	16.2	81	10	0.14	<0.05	450
6/19/2003	8.34	21.7	94.8	83	42	8.01	23.6	61	5	0.11	0.05	230
7/2/2003	gate locked	no access										
7/17/2003	7.7	25.9	94.4	1	66	meter mlfx	6.16	53	3	0.2	0.11	>2500
7/31/2003	7.04	26.2	87.2	126	63	meter mlfx	13.5	59	4	0.1	0.06	1200
8/14/2003	7.57	21.7	85.7	122	62	meter mlfx	12.6	28	5	0.11	0.07	340
8/27/2003	7.7	21.5	87.3	132	66	meter mlfx	13.3	56	5	0.15	0.06	300
9/10/2003	8.94	15.7	90.1	172	86	meter mlfx	9.89	11	<3	0.025	<0.05	20
9/25/2003	8.95	15.3	89.3	197	99	8.3	16.7	26	<3	0.07	<0.05	90
10/9/2003	9.02	15.4	90.2	204	99	8.33	15.8	12	<3	0.06	0.05	20
10/22/2003	9.53	9.8	84	207	101	8.17	0.69	5	<3	0.12	0.06	50

Payette Drain												
PD-2	Mid site											
Date	DO	Temp	%Sat	Cond.	TDS	pH	Discharge	TSS	TVS	TP	OP	e-coli
4/30/2003	9.79	11.1	89	103	52	7.05	59.5	55	9	0.11	<0.05	220
5/14/2003	9.08	15.3	90.6	119	61	7.77	67.9	63	6	0.1	<0.05	360
5/29/2003	8.12	18.5	86.8	122	54	7.57	62.9	131	10	0.21	0.05	690
6/12/2003	8.34	18.6	89.2	95	46	7.81	64.3	93	7	0.15	0.05	160
6/25/2003	8.76	17.9	92.2	112	57	7.92	67.5	75	7	0.11	<0.05	<10
7/10/2003	7.54	22.8	87.5	98	50	meter mlfx	65.5	103	9	0.07	0.06	14
7/24/2003	6.42	24.7	77.3	118	60	meter mlfx	69.6	63	8	0.11	<0.05	350
8/6/2003	6.67	23.4	78.3	96	49	meter mlfx	68.5	37	4	0.07	<0.05	460
8/20/2003	7.07	22	80.9	110	55	meter mlfx	67.2	32	<3	0.1	<0.05	220
9/3/2003	7.42	20.6	82.5	114	57	meter mlfx	66.4	43	4	0.11	<0.05	160
9/18/2003	9.06	14.8	89.3	189	94	meter mlfx	49.6	12	<3	0.05	<0.05	70
10/1/2003	8.23	17.2	85.6	200	101	8.18	48.2	19	3	0.08	<0.05	120
10/21/2003	8.9	13.4	85.3	203	106	8.22	39.7	14	<3	0.06	<0.05	80

Payette Drain	At Payette	Diversion										
PD-3												
Date	DO	Temp	%Sat	Cond.	TDS	pH	Discharge	TSS	TVS	TP	OP	e-coli
4/30/2003	10.09	9.9	86.5	92	46	7.6	no discharge	13	4	0.05	<0.05	150
5/14/2003	10.19	13.6	97.9	97	49	7.64	no discharge	19	4	0.06	<0.05	450
5/29/2003	8.63	18.5	86.8	61	31	7.13	no discharge	49	12	0.1	<0.05	550
6/12/2003	8.52	16.4	87	64	34	7.15	no discharge	37	3	0.07	<0.05	530
6/25/2003	8.52	16.6	87.5	77	39	7.07	no discharge	19	5	0.05	<0.05	360
7/10/2003	7.59	22.2	86.8	86	44	Meter mlfx	no discharge	25	6	<0.05	<0.05	>2500
7/24/2003	5.88	24.5	70.8	97	50	Meter mlfx	no discharge	29	7	0.08	<0.05	170
8/6/2003	6.36	23.1	73.9	93	47	Meter mlfx	no discharge	19	<3	<0.05	<0.05	100
8/20/2003	7.45	22.4	85.9	103	51	Meter mlfx	no discharge	12	<3	0.08	<0.05	140
9/3/2003	7.62	20.9	84.8	110	56	Meter mlfx	no discharge	30	<3	0.08	<0.05	80
9/18/2003	9.4	14.4	92.2	178	89	Meter mlfx	no discharge	8	<3	<0.05	<0.05	80
10/1/2003	8.24	16.8	84.7	194	98	8.03	no discharge	18	5	0.06	<0.05	210
10/21/2003	9.15	13.6	87.9	186	94	8	no discharge	19	4	<0.05	<0.05	130